CLAIMS

What is claimed is:

1. A method for producing a steel rail having a high content of carbon, comprising:

finish rolling said rail in two consecutive passes, with a reduction rate per pass of a cross-section of said rail of 2-30%,

wherein conditions of said finish rolling satisfy the following relationship:

$S \leqq CPT1$

wherein CPT1 is the value expressed by the following expression 1

$$CPT1 = 800 / (C \times T) \qquad \text{(expression 1)}$$

wherein

S is the maximum rolling interval time (seconds), and

$(C \times T)$ is defines as follows;

C is the carbon content of the steel, wherein the carbon content is more than 0.85 mass%, but less than or equal to 1.40 mass%, based on the total mass of the steel, and

T is the maximum surface temperature (°C) of a rail head.

2. A method for producing a steel rail having a high content of carbon, comprising:

finish rolling said rail in three or more passes, with a reduction rate per pass of a cross-section of said rail of 2-30%,

wherein conditions of said finish rolling satisfy the following relationship:

$S \leqq CPT2$

wherein CPT2 is the value expressed by the following expression 2,

$$CPT2 = 2400 / (C \times T \times P) \qquad \text{(expression 2)}$$

wherein

S is the maximum rolling interval time (seconds), and

(C × T × P) is defines as follows;

C is the carbon content of the steel rail, wherein the carbon content is more than 0.85 mass%, but less than or equal to 1.40 mass%, based on the total mass of the steel, and,

T is the maximum surface temperature (°C) of a rail head, and P is the number of passes, which is 3 or more.

3. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises at least one selected from the group consisting of (a) Si in an amount of 0.05-2.00 mass%, and (b) Mn in an amount of 0.05-2.00 mass%; said rail having a balance of Fe, optionally including impurities.

4. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises at least one selected from the group consisting of (a) Cr in an amount of 0.05-2.00 mass%, and (b) Mo in an amount of 0.01-0.50 mass%; said rail having a balance of Fe, optionally including impurities.

5. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises B in an amount of 0.0001-0.0050 mass%, and a balance of Fe, optionally including impurities.

6. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises at least one selected from the group consisting of (a) Co in an amount of 0.003-2.00 mass%, and (b) Cu in an amount of 0.01-1.00 mass%; said rail having a balance of Fe, optionally including impurities.

7. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises Ni in an

amount of 0.01-1.00 mass%, and a balance of Fe, optionally including impurities.

8. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises at least one selected from the group consisting of (a) Ti in an amount of 0.0050-0.0500 mass%, (b) Mg in an amount of 0.0005-0.0200 mass%, and (c) Ca in an amount of 0.0005-0.0150 mass%; said rail having a balance of Fe, optionally including impurities.

9. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises Al in an amount of 0.0100-1.00 mass%, and a balance of Fe, optionally including impurities.

10. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises Zr in an amount of 0.0001-0.2000 mass%, and a balance of Fe, optionally including impurities.

11. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises N in an amount of 0.0060-0.0200 mass%, and a balance of Fe, optionally including impurities.

12. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises at least one selected from the group consisting of (a) V in an amount of 0.005-0.500 mass%, and (b) Nb in an amount of 0.002-0.050 mass%; said rail having a balance of Fe, optionally including impurities.

13. The method according to claim 1 or claim 2, wherein chemical composition(s) included in said rail meet the following relationship:

$0.30 \geqq V(mass\%) + 10 \times Nb(mass\%) + 5 \times N(mass\%) \geqq 0.04$

14. The method according to claim 1 or claim 2, further comprising:

immediately after said finish rolling, cooling the surface of said rail head at a cooling rate of 2-30°C/sec. until the surface temperature reaches 950-750°C.

15. The method according to claim 14, further comprising:

after said cooling step, when the temperature of the rail head is more than 700°C, cooling the surface of the rail head at a cooling rate of 2-30°C/sec. until the surface temperature reaches at least 600°C; and then

allowing the rail to further cool at room temperature.

16. The method according to claim 1 or claim 2, further comprising:

after said finish rolling process, when the temperature of the rail head is more than 700°C, cooling the surface of the rail head at a cooling rate of 2-30°C/sec. until the surface temperature reaches at least 600°C, and then

allowing the rail to further cool at room temperature.